DOCUMENT RESUME

ED 453 238 TM 032 589

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TITLE Small Group Collaboration in the Large Lecture Setting: Collaborative Process, Pedagogical Paradigms, and Institutional Constraints.

PUB DATE 2001-04-12

NOTE 19p.; Paper presented at the Annual Meeting of the American Educational Research Association (Seattle, WA, April 10-14, 2001).

PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS *Cooperative Learning; Curriculum Development; *Group Dynamics; Higher Education; *Large Group Instruction; Lecture Method; Small Group Instruction; *Undergraduate Students

ABSTRACT

This paper focuses on some of the key issues involved in implementing a collaborative design project in the setting of the large undergraduate lecture course at a major research university, offering a preliminary analysis of the assignment mainly as a function of how students managed and interpreted it. The collaborative design project was assigned to students in the Human Biology Core Course at Stanford University in 1999. At staggered points throughout the quarter, 24 groups of approximately 10 students each were asked to produce informative Web sites on assigned topics. A number of approaches, including videotaping cooperative sessions, focus groups, and student surveys, were used to study group interactions for two of these groups. Findings show that each of the two groups experienced different types of successes and difficulties. One group engaged more deeply with the course content and developed an egalitarian and supportive participatory structure for its members. This group demonstrated greater learning and greater success at collaborating than the members of the other group. The other group managed its problems of project and resource management largely by working in subgroups and treating a fairly simple project in the most straightforward manner possible. The group members did not necessarily learn a great deal about their topic overall, but they produced a superior final product as assessed for a course grade. These findings draw attention to the different strands of the group process that are entailed in collaborative design. They point to the need for adequate scaffolding along each of several lines to avoid problems. (Contains 35 references.) (SLD)

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Small Group Collaboration in the Large Lecture Setting: Collaborative Process, Pedagogical Paradigms, and Institutional Constraints

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TM032589

Paper to be presented at the annual meeting of the American Educational Research Association (Roundtable Session No. 22.01). April 10 – 14, Seattle, Washington.

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Introduction: Making Sense of an Assignment

The Problem

As the use of collaborative learning approaches in higher education increases (Gamson, 1994; Lazerson et al., 2000), so does the challenge of evaluating these approaches and deriving from them principles of good practice (Barron et al., 1998). Efforts to create learning environments based on research findings that support collaborative, problem-based, design-oriented, and other student-centered pedagogies are potentially complicated by disparities between these new instructional methods and well-established features of research universities. This paper focuses on some of the key issues involved in implementing a collaborative design project in the setting of the large undergraduate lecture course at a major research university, offering a preliminary analysis of the assignment mainly as a function of how students managed and interpreted it.

A Perspective on Paradigms

Pedagogically, groupwork in the lecture course represents something of a strange hybrid. The large lecture course, a mainstay in the research university, is emblematic of much of what is considered wrong with contemporary higher education. Despite its industrial-age efficiency, its long tradition of acceptance, and its widely acceded usefulness for at least some purposes (Shulman, 2000), the undergraduate lecture course in its characteristic form has come under attack from many quarters. Critics argue that the lecture format fails to involve students, that it insures student anonymity, that it provides students little or no useful feedback, that it discourages intellectual engagement, and, at the extreme, that its practice is educationally vapid and counterproductive (Boyer, 1998; Bruffee, 1999; Kellogg Commission, 1997; Kuh & Hu, 2001; Lazerson et al., 2000). Indeed, the undergraduate lecture course embodies assumptions that have long been discredited in K-12 education: that teaching is transmission, knowledge is an inert commodity, and learning occurs by passive reception (Bransford et al., 2000; Sheppard, 2000).

The preponderance of current educational theories and research findings runs counter to the knowledge transmission model of learning inherent in the large lecture course (e.g., Bransford et al., 2000; Greeno & MMAP, 1998; Shepard, 2000). Although the lecture course format is still common at research universities,[2] there are ways in which instructors attempt to ameliorate its negative features—for example by assigning

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[2] Massey & Wilger (1999), among others, discuss the reasons for the persistence of the kinds of archaic educational practices seen at the research university. This discussion lies beyond the scope of our paper.

students to participatory discussion sections (Coppolla, 1995) or instituting mechanisms for rapid feedback (Schaeffer et al., 2001). The introduction of collaborative groupwork into the large lecture course signifies a bold step away from the educational paradigm underlying the lecture format. The model of learning underlying collaborative groupwork eschews knowledge transmission notions in favor of concepts that place learners at the center of active knowledge construction processes.

Theoretical perspectives on collaborative groupwork emphasize the social nature of learning (Wertsch, 1985), the value of problem-based approaches (Barron et al., 1998), the importance of apprenticeship and scaffolding (Lave & Wenger, 1991), the situativity of cognition (Greeno & MMAP, 1998), the hypothetical characteristic of all knowledge (Greeno et al., 1999), the isomorphism of participation in activity and learning (Rogoff, 1995), and notions of distributed or collective intelligence (Pea, 1993). Research into student collaboration shows that it can promote a range of important educational outcomes, including higher levels of achievement (Slavin, 1996), better understanding of text (Fall et al., 2000), higher order thinking (Cohen, 1994), improved communication and conflict management (Johnson & Johnson, 1996), strategic problem-solving skills (Barron, in press), and, at the undergraduate level, persistence in college (Springer, Stanne, & Donovan, 1997). Conversation appears to be the primary mechanism through which students deepen their understanding in collaborative interactions. By discussing, elaborating, and disputing ideas, students interactionally create new conceptual nodes and linkages that they are able to appropriate and apply (Barron, in press; Bruffee, 1999; Cohen, 1994; Fall et al., 2000; Greeno, et al., 1998; Lemke, 1990; Resnick et al., 1993; Roschelle, 1992; Webb et al., 1995; Wertsch, 1985).

The differences between the two paradigms of learning we discuss above are not simply abstractions, removed from the everyday experience of students. Instead, these paradigms produce distinct, and, in the view of many theorists, competing practical epistemologies (Bruffee, 1999; Greeno et al. 1999). Learners participating in activities structured according to the knowledge transmission paradigm experience *knowing* in ways different from learners participating in collaborative work. Bruffee (1999) describes a process of "reacculturation" in which students move from the experience of being recipients of information to the experience of becoming increasingly competent participants in discourse communities. For the reacculturated student—a student regularly participating in the active construction of knowledge in a collaborative environment—learning has come to mean something different from what it meant before. Greeno et al. (1999) express similar views in discussing the importance of viewing all forms of knowledge as a "working hypothesis." This alternative conception of knowledge fundamentally changes the way people act and feel about themselves as learners.

The approach taken in this study is modeled after studies aimed at describing the ways in which groups of persons both organize and experience the activities of their daily lives (e.g., McDermott, 1993). Theoretically, our focus on group process arises from the view that learning should be seen as a socially organized, situated, and participatory activity (Greeno, 1997; Lave, 1996). A key element of how students participate in—and therefore have the opportunity to learn from—group activity is how they themselves organize the structure of the activity in terms of relative positions, role assignments, subtask involvement, types of accountability, physical arrangements, levels of conversational engagement, and other factors (e.g., Barron, in press). A given assignment provides some structure, but the process by which students achieve their objectives is substantially organized by the students themselves.

Purpose and Rationale

Our evaluation of a collaborative groupwork assignment in a large lecture setting takes a broad approach. Our goal is to address the educational effectiveness of the assignment, the students' response to it, and the implications of our analysis for future work. Our analyses use a number of complementary means to shed light on how the two competing paradigms—knowledge transmission and collaborative construction—matter in the group activities. We include the kinds of epistemological meanings students are likely to encounter and grapple with as a result of this type of experience. We examine the details of how students managed the constraints and affordances of their collaborative assignment to understand what kinds of learning the assignment allows. More broadly, we interpret the students' behaviors in terms of the learning paradigms entailed in this collaborative situation. While looking at how students manage —and are managed by—the assignment, we also are looking for how the educational paradigms surface in the students' activity.

The Assignment

The collaborative design project discussed in this paper was assigned to students in the Human Biology Core course at Stanford University during the Spring of 1999. The Human Biology Core is structured as a traditional large lecture course. The enrollment during the time of the study was approximately 200 students. The class met for three 1-hour lectures each week, and students were required to attend weekly, one-hour discussion sections of approximately 20 students. The sections were each led by one of six course assistants.

At staggered increments throughout the quarter, 24 groups of approximately 10 students were asked to produce informative websites on assigned topics relating to the course subject matter of environmental and health issues. Students were told that these

websites would be incorporated into the course materials for the entire class. The groups had four weeks to finish their projects.

The teaching staff provided students with a model website, content guidelines, and a list of grading criteria that emphasized content accuracy, organizational clarity, and readability. Students from each of the 24 groups were required to meet with a specially designated course assistant whose job it was to monitor each group's progress, particularly in relation to the group's site design. Technical assistants were assigned to each group, and training in website production tools was available to any student interested in participating. Students were required to submit drafts of their sites for peer review. In short, the students were provided with guidelines and tools for creating their websites, but these tools focused more on the condition of the artifact than on the steps necessary to produce the artifact. There were, consequently, few constraints on how the students worked together and how they structured their tasks.

The intended purposes of the group assignment as described by the course instructor, Professor Donald Kennedy (faculty member, one of the founders of the program in Human Biology, and President emeritus of Stanford University), matched well with research findings on collaborative learning. When asked about the goals of the assignment, Kennedy identified two equally important objectives: "Learn how to work together. And ... dig deeply into an interesting question... Actually, I really do think that working together and having the depth experience are sort of tied for first" (quoted in Schaeffer et al., 2000)[3]

Both increased interdependence among peers and deeper engagement with concepts rank as important outcomes in the literature on student collaboration (Barron, in press; Bruffee, 1999; Cohen, 1994). In addition, the collaborative assignment described here was fundamentally a design activity, and consequently carried the promise of providing the benefits associated with the open-ended, multifaceted, complex problem-solving characteristics of design (Rapatan, 1998).

Methods

Overview and Rationale

[3] Kennedy has been very explicit at other times about his concern over the general lack of experience Stanford students have working collaboratively: "In 12 years as President of this place, going around, talking to various people about Stanford graduates ... it was irresistibly tempting for me to ask them the question, 'Well, what do you think of 'em? What do you think of these guys?' The most common complaint I got was, 'They're very smart, but they really don't know how to work in a--as a-- team. ... Somebody hasn't given them the message that everything that happens in the real world happens as a result of collaborative efforts" (Schaeffer et al., 2000).

We used a number of approaches aimed at revealing features of the students' collaborative process, on the finest scale, to examining the structure of the course and its place in the university's academic program, at the highest level. The research team videotaped selected collaborative groupwork sessions; collected survey data from students; conducted focus groups with students and teaching assistants; interviewed individual faculty, teaching assistants, and students; collected artifacts relating to the assignment and student assessment; and captured email exchanges between students.

The methods used in this study center on video-recordings made of two of the 24 student groups in the course. The groups had four weeks to finish their projects, and the video-recordings of the two groups were made at their weekly planning meetings. A core piece of our analysis involves coding the videotapes of student groupwork sessions to be able to characterize aspects of the collaborative process. The research team is comprehensively coding videotapes of the collaborative work sessions of four student groups, two from the first year of the evaluation (1999) and two from the second year (2000). The coding scheme being applied breaks the group sessions into tasks, noting for each task: (1) its type (vanDam, 1993), (2) the degree to which the group members respond to one another's contributions and follow norms of polite interaction (Barron, in press), and (3) the degree to which students mutually align themselves in relation to the task (Barron, in press).

The main purposes for coding the group interactions are to look at student interaction for evidence of how students construe the assignment, their own objectives, and their own position as collaborative learners. Also, we will investigate correlates between types of group interactions and outcomes in terms of group product, student satisfaction, and student grades. These approaches will allow us to see the ways in which the pedagogical paradigms and institutional constraints articulate with the practical, everyday experiences of students. For the purposes of this paper, we focus on the first year's activity and on only a subset of our codes.

Participants

The research team used the timing of the assignment as the main criteria by which to sample two groups that were likely to have different experiences. One of the groups was assigned to work on its project in the earlier portion of the academic quarter (weeks two through six) and the other group did its project towards the end of the quarter (weeks six through ten). This difference in timing affected how many websites produced by other student groups each group was able to use as a model for its own work. The group working earlier in the quarter, coded Group A, had only the model site created by the teaching staff to use as a point of comparison in producing its own site, whereas the group working later, coded Group B, had other student sites on which to base its

comparison. The research team also used the criterion of selecting groups with different section leaders when choosing the sample.

All groups in the study were assigned topics for their websites by the teaching staff. These topics differed significantly in a number of ways, including in relation to the contemporary policy implications for each. Group A was assigned to produce a website on a topic related to environmental issues of primarily historical significance. Group B's topic centered on a current social problem with health-care policy implications.

As it turned out, Group A included students who had produced websites before and knew how to code in HTML. Although many students in Group B were technologically proficient, none of them had experience in creating websites.

Procedures

Surveys. Members of the groups answered brief online surveys regarding their experience immediately after completing their design projects, and at the end of the quarter.

Email capture. While observing Group A we realized that much of their interactions occurred over email. To capture those exchanges for the next group, we set up an email archive for email exchanges among members of Group B.

Videotaped meetings. Both Groups A and B were given access to a specially equipped room with a SmartBoard, Internet access, and built-in video cameras. This room was reserved for each of these two groups at a regular weekly time when all the group members were available to meet. Students in these groups were also loaned video equipment and trained how to record group meetings that occurred somewhere other than the designated room.

Video-based interviews. The research team used the video-recordings of weekly meetings by: 1) analyzing them for the purposes of finding key dimensions in group process; 2) developing interview questions based on these analyses and on particularly representative or intriguing sequences from the tape; and 3) using the questions and a few strategically selected video clips as part of an interview schedule with volunteers from each of the groups. This process allowed researchers to show selections of videotape from their own group work to students for their interpretations during an open-ended interview after researchers had done a preliminary analysis of the videotapes. Two researchers met with three representatives from each of the two groups in separate interviews for each group, and the interview itself was video-recorded. The researchers used information from other sources, such as email exchanges and the answers to brief survey questions, to formulate their initial ideas about each group's process. Students' own comments, concerns and ideas from the interviews were used to further analyze the videotapes of the group meetings, which led to a revised account of the two groups' processes.

Coding Scheme and Procedures

Several members of the research team viewed the videotapes for the student collaborative sessions, with one person leading the analysis for each of the two pairs of groups being studied. Through several viewings and discussions the researchers proposed and agreed to sets of codes for segments of tape viewed collectively. Approximately one-sixth of the videotapes have been coded; coding will continue for all recordings of these two groups' meetings.

One set of codes we have developed categorizes the types of tasks the students undertake. Our codes for task descriptions allow us to provide basic answers to the questions: What do these collaborative groups do when they collaborate? How do they spend their time? How is this time structured? For each type of task, we identified whether the task was a main task, a sub-task (i.e., a task within a main task that contributes to the accomplishment of the main task), or an embedded task (i.e., a task within a task that does not directly contribute to the accomplishment of the superordinate task). We have identified 21 main types of tasks the fit into the following three categories: 1) tasks affecting the organization of group activity; 2) tasks affecting the creation of the artifact; and 3)tasks affecting interpersonal relationships and affiliation. Our analysis of data from these codes focuses on the amount of time students spend on particular tasks and how this time is structured in relation to other tasks, including the frequency with which students take up particular tasks.[4]

Results

The results are presented for each of the main methods.

Video analysis

The video analysis revealed noteworthy differences in how each of the groups managed the assignment. In comparison to Group A, Group B demonstrated a better group process with regard to several key characteristics:

- level of topic interest and task motivation;
- level of conversational engagement with and elaboration of the topic;
- level of whole-group alignment on the content and tasks entailed by the project;
- type of group working structure (allowing for wide participation).

Further analyses of the videotape support our interpretations of the meaningful differences between the ways in which the two groups functioned, especially with regard

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[4] In addition to the task description codes, we are also coding the characteristics of group interaction. These codes will be developed further and discussed in a future paper.

to their development of content. Comparing the two groups based on their first group meetings is illustrative. Each group initially met for approximately 50 minutes, but the nature of those meetings differed. For example, Group A, spent approximately 5.5 minutes in only two segments (discrete periods of time on one task) discussing content. Most of this content-related discussion revolved around basic definitions and clarification of the topic, and not on elaboration and expansion of ideas. Much of the rest of the group's time was spent on tasks tangential or unrelated to the creation of a website. In contrast, during its first meeting, Group B spent approximately 21 minutes in eight different segments directly discussing content. Little of this conversation is simply definitional or preliminary. Members of Group B mapped an elaborate content structure, looking for lines of causality and explicitly framing their ideas in terms of the pedagogical value for other students in the course. Group B began its work on the project by elaborating content and developing areas of complexity to the extent that it created for itself many additional challenges.

In addition to how the groups organized their time relative to tasks, the students in the two groups differed in terms of how they interacted. The pace of talk was much slower for Group A than for Group B, with lengthy (frequently more than one second) pauses between speaking turns for the former and a quick pace that included a great deal of latching (i.e., beginning to speak just as the previous speaker is finishing) for the latter. With regard to responsiveness to one anothers' verbal contributions, Group A's interactions included many dropped initiations, changes of subject, and self-reference (Barron, in press). In contrast, Group B's members followed through more consistently on initiations. Group A's members did not maintain shared attention on the primary tasks, and instead split into sub-groups that engaged in a variety of off-topic activities. Group B's members, in contrast, stayed convened as a whole group for more of their meeting time, providing them with more opportunity to address collectively the issues presented by the assignment.

In terms of affect, the quality of Group A's interactions differed from that in Group B's. Group A had what might be characterized as a confrontational subtext, with occasional overt criticism surfacing from one member to another. Group B interactions included much more humor and seemed both more relaxed and enthusiastic. From the first moments of Group A's first meeting, one individual affected the group's participatory structure by frequently trying to establish himself as the group's leader. Group B, in contrast, had an emergent and ad hoc leadership, mutually "appointed" by members in relation to accomplishing particular tasks.

Another key area in which the groups differed was in how they managed the particular requirements of the assignment. Group A had fewer negotiations regarding the specifics of completing the many entailed tasks and subtasks. The members quickly decided what needed to be done (e.g., generate text for a particular portion of the site)

and who would do it. Group B began discussing the required tasks and subtasks early in their group process, but brought these discussions to a relatively drawn out closure, with fewer decisions being made in the earlier phase of their time working together.

Noteworthy is that Group B made frequent reference to and drew upon the experience of other groups that had already completed the assignment. Group A was not able to do this since they were in the first contingent of groups doing the assignment.

Surveys

Student self-reports on their experiences in the web-design project revealed additional differences between the groups. Group A members averaged well below the class on their interest in topic, both before and after the project. Group B's members reported more than average interest in their topic. Both groups' members reported working longer hours on the design project than the class average, but Group B's members reported working significantly longer hours than did Group A.

The student surveys also showed some similarities between the groups. Both groups were at the class average in their self-report on the amount they learned and the smoothness of their group dynamic. Both groups also were less enthusiastic at the end than the class on average about the course as a whole.

Group Interviews

Despite the many ways in which Group B had a good group process, during their interview members of this group described a number of difficulties they confronted in completing their web site. In contrast, members of Group A did not have unanticipated project management problems in the same way as Group B. Group B's members felt that they had many interesting and good ideas, but they also reported not having adequate teamwork to complete their assignment smoothly at the end. They reported having a number of tasks in the final phase of the project needing to be done, but which no one in the group volunteered to do. This made the final stages of the project particularly difficult for the webmasters, leading, in the estimation of several group members, to an inadequately edited site. In contrast, Group A's members stepped in to fill roles as needs arose during the course of their project.

As mentioned above, Group A had more technical skill within its ranks. However, the most technically proficient member of the group who acted as the webmaster for the site described in the interview the difficulties he had working with other members of the group, particularly, the self-appointed leader. This person repeatedly tried to contribute to the completion of the site without having the technological skills to do so. This detracted a great deal from the time and effort of those actually constructing the site.

Nonetheless, Group A expressed few of the types of complaints expressed by Group B, even when asked straightforwardly. Although their topic was uninteresting to them and their webmaster thought a web-based project inappropriate for the course, overall they felt their group worked efficiently and cooperatively.

Summary of Results

Table 1 summarizes our findings described in terms of the primary problems faced by each of the two groups.

Table 1. Difficulties Faced by Sample Groups

Group A	Group B
Off-task, down time	Complexification
Lack of knowledge	Delay of role assignments
Lack of enthusiasm	Open-ended milestones
Minimal elaboration	Lack of follow -through and responsibility
Separate lines of activity	More problems with project management
Unaligned attention	
Poor outline	
Lack of inclusion and responsivity	

Discussion

Our results indicate that each of the two groups experienced different types of successes and difficulties while undertaking this assignment. Group B engaged more deeply with the course content and developed an egalitarian and supportive participatory structure for its members. The group demonstrated greater learning and greater success at collaborating than the members of Group A. Despite these successes, Group B struggled,

particularly at the end of the project, to complete its assignment in a manner satisfactory to the group. The organizational structure that the group's members created for themselves was insufficient to match the components of the task. The students under-specified the sub-tasks needed for completing the web site, and therefore did not succeed in mapping personnel roles adequately to jobs.

The problems Group B faced in the end were largely problems of project and resource management; Group A managed to mitigate these by working primarily in subgroups and by treating a fairly simple and straightforward topic in the most simple and straightforward manner possible. Group A minimized complexity and maximized efficiency, but the group members did not necessarily learn a great deal about their topic overall in doing their project. Still, they produced a superior final product as seen through the lens of course grades. The reasons for Group A's better grade seem to be related largely to the manageability of their project. Specifically, the group appears to have simplified their problem, to have paid more attention to the completion process, and to have done a better job of anticipating the project requirements. Additionally, group members willingly stepped in when extra tasks arose.

Table 2 summarizes the outcomes for each of the groups:

Table 2. Outcomes Achieved by Sample Groups

Group A	Group B
Worse interaction: unaligned attention, lack of inclusion	Better interaction: aligned attention, mutuality, inclusive
Less conceptual elaboration, limited idea development	More conceptual elaboration, idea development
Less learning	More learning
Simplification of process; reducing ambiguity	Complexification of process; maintaining ambiguity
Better success in accomplishing the task (one "webmaster")	Less success in accomplishing the task (delay of role assignments; problems with project management)
Better grade	Worse grade

In comparing our two groups, the group showing the higher level of knowledge, interest, engagement, collaborative effort, and conceptual elaboration and understanding of their topic struggled, in the end, to meet the course-imposed requirements for finishing their website. This meant that the group with the superior learning process, as measured by researchers' evaluations, produced the inferior product, as measured by course grades

Overall, our analysis indicates that in undertaking the assignment, students' most serious problems arose not with content development, technical execution, or group interactions, even though these three areas of the design activity affected their processes and outcomes; rather, the most serious difficulties encountered by the students in this study arose in relation to the *structure* of the website creation activity itself. By not being able to anticipate the constitutive tasks and subtasks of the activity as well as its overall organization, one group was unable to plan adequately for the functions its members would have to fulfill to successfully complete the project. This analysis highlights the importance of students' ability to anticipate and manage these constraints, de-emphasizing the importance of such factors as content knowledge, engagement with the topic, open and inclusive discussion of ideas, and information sharing. This analysis therefore underscores the effect of more structural issues relating to the practical accomplishment of the task within its deadlines. What collaborative design groups learn about their content area does not necessarily map on to how well the group is able to perform its assigned task of producing an artifact.

Conclusions

Seen from a more general perspective, a close look at group process indicates that a group's final product can be deceptive in terms of how inclusive, engaging, and pedagogically valuable the group activity itself actually is. In groupwork, there is often a great deal of learning that does not get properly assessed by an evaluation of only the final product. The complex relationship between process and product indicates the need for revised and even reconceptualized assessments, ones that are aligned with intended learning outcomes. The potential mismatch between process and product also indicates the need for an analysis of group process for the purposes of designing effective collaborative learning environments.

Our findings draw attention to the different strands of group process that are simultaneously entailed in collaborative design. This work shows that these interrelated strands constitute different potential pitfalls for students undertaking collaborative design projects, and points to the need for adequate scaffolding *along each of several* lines to avoid these problems. A group website design project—even one undertaken by high-achieving, collaboratively competent, and resourceful university students—can get

derailed by an academic institutional order that requires a single product evaluated by traditional means according to a rigid timeline, unless students receive sufficient support in working within these constraints.

In the case presented here, the most appropriate scaffolding would have given students better ways of mapping their own efforts onto the tasks comprised by the overall design activity they were undertaking. Students needed resources additional to the ones they had and they also needed additional constraints, such as interim deliverables. Most students were making an initial foray into website production. These students would have been helped if they had more indicators at early stages of their project as to what types of tasks and responsibilities they would face in completing the project. Specifically, they needed to be oriented to practical requirements, including that the content of the site would have to be checked and edited once each student or group had given the webmaster their text. The group as a whole would need to be responsible for the site as a whole. The student groups also would have benefited greatly from an assignment structured to help them conversationally engage with the material they researched in order to transform that material collectively into something of their own; that is, they needed topics that required them to do purposeful analyses. As it stood, the project merely required re-presentation of facts without much added value, including at the level of composing a whole, integrated site.

Based in part on the Stanford Learning Lab's evaluation (Schaeffer et al., in preparation), the Human Biology Core collaborative group assignment was changed in its next iteration the following year. The teaching team for the course: (1) reduced the size of the groups to five students each, (2) required students to collectively develop a policy position based on their research findings, (3) assigned students to write an individual paper on their topic before writing the group paper, and (4) eliminated the technical requirements for the project by assigning the students to write a paper (posted on the web) instead of to create a web site.

The findings from the preliminary analysis of the second iteration follow along lines similar to first year's assignment discussed in this paper. Generally, students in the second year's groups collaborated well and used their time together to conceptualize, elaborate, and refine the content matter on which their group projects focused. Despite some differences in the degree to which the groups successfully collaborated—where success is defined as participation along several specific dimensions of activity—the most salient issues for the groups had to do with the ways students managed the constraints and affordances of their assignments. Additionally, although the both groups overall engaged deeply with the content of their projects and achieved, in most instances, high quality patterns of collaborative interaction, the assessment of their final projects by the course teaching staff did not account for these accomplishments. The differences in the second year between the students' informal self-assessments and the instructors'

assessments points to a disjunction between several of the important dimensions of learning through collaboration and the kinds of assessment that are characteristic of large university lecture classes.

A danger inherent in the introduction of collaborative groupwork into the large lecture setting is that, unless implemented appropriately, such groupwork can result in giving students the wrong message. The best features of collaborative activity can be left unsupported, students' efforts to learn can be overwhelmed by students' efforts to manage their project, assessments can focus on presentation of standard information in conventional ways, and the learning that occurs through vibrant, progressive discourse can inadvertently either get overlooked or discouraged. In the case of the assignment analyzed in this paper, the student websites were originally intended to become part of the course readings for all students in the class. This aim was dropped because it was difficult to achieve, signaling to students that the ostensible authentic purpose for their sites (i.e., teaching other students) was not, in fact, authentic, or at least as important as other features of the course. Additionally, the students' efforts in the collaborative design project had to be subsumed to their efforts to prepare for conventional midterm and final exams, which constituted the bulk of the course grade. The contradictory and even somewhat insidious message students get in such circumstances is that even though lip service is given to collaboration, student assessment is still based on information acquisition and still adheres to educational norms of competitive individualism.

Our research shows that collaborative groupwork in the lecture course—and in other undergraduate settings as well—can end up straddling two paradigms. Under such circumstances students experience, at best, the ambiguity produced during a transitional state, and, at worst, a form of epistemological counter-productivity. In the short term, faculty interested in promoting collaboration must attend carefully to the way the assignment and the learning environment of the course itself are structured. In the long term, faculty interested in promoting collaboration must take seriously the types of reform efforts that can align the rest of the university's institutional order with the basic principles of good collaborative activity. It may be that in order to be implemented successfully, collaborative learning environments need to be implemented fully. Meanwhile, the challenge is to signal to students that, in fact, our most important educational objectives are not for them to absorb information or even for them to effectively manage their educational careers by efficiently managing their assignments; rather, the most important objectives are for them to work together to solve meaningful problems, to engage with content deeply through conversation, and to create participatory structures that include fellow students in the processes of learning.

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